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December 28, 2007

RE: Murphy v. Southern Energy Homes

On October 24, 2007 I inspected the residence of Kelly Murphy located at 5489 Washington Ferry Rd., Montgomery, AL.

The purpose of the inspection was to evaluate the items listed in the expert's report of Mr. Bobby Parks, Mr. R.T. Bonney, and Mr. Kondner, P.E.

My report is based upon my visual and intrusive inspection of the Murphy's residence and the documents you provided.

Each report will be identified and addressed separately.

1. Mr. Parks report (not dated):

Mr. Parks states the purpose of his investigation of the Murphy's residence and his conclusions are as follows:

> "1) Elevated moisture content within the perimeter walls causing structural softening and deflections.
>
> 2) Possible fungal-like growth within the home."
>
> The following conclusions are based on information gathered from this investigation. This home was found to have several serious non-compliant code issues causing structural deterioration and mold growth. Issues include;
>
> "1) Improper application of the wall construction standards.
> Does not concur with basic engineering practices or meet the prescriptive Standards which requires *"home producers in assuring that homes built and sited in humid and fringe climates are durable and free of moisture-related problems."
> *24 CFR Part 3280 [Docket No. FR-4578-F-02] / 3280.504(b)

In Mr. Parks conclusion 1), improper application of wall construction standard is incorrect in stating the wall construction is improper and it does not meet basic engineering practices or meet the prescriptive requirements of the HUD Standards. Mr. Parks does not specifically identify any aspects of the Murphy's residence that was not designed or constructed in accordance with good engineering practices or the HUD Standards. HUD oversees the Federal Manufactured Home Construction and Safety Standard and develops the code through a consensus process that relies on professionals that have expertise to make recommendations to a consensus committee by supplying conclusive technical documentation on issues that will become code and establish good engineering practice. Meeting the specific requirements of the codes is meeting good engineering practices.

Section 3282.361(b) states "(1) In evaluating designs for compliance with the standards, the DAPIA will not allow any deviations from accepted engineering practice standards for design calculations or any deviations from accepted test Standards, except that the DAPIA, for good cause, may request the Secretary to accept innovations which are not yet acceptable practices. Acceptances by the Secretary shall be published in the form of interpretative bulletins, where appropriate." It is the responsibility of the DAPIA to insure good engineering practice is met, which is following the Standards as written and obtaining interpretations from the Secretary when appropriate.

The DAPIAs have been told in numerous meetings with HUD Regulators since June 15, 1976, that they must adhere to the Standards as written and applying additional requirements not in the Standards or making interpretation of the Standards is considered rulemaking and must go through the process as required in the regulations section 3282.

If Mr. Parks was an expert in the HUD Standards relating to wall design and condensation control, he would know that good engineering practice is determined by the DAPIA's as required in the regulations section 3282.361(b), that good engineering practice meet the prescriptive requirements of section 3280.504 (b)(1), that IBTS (HUD's agent) has evaluated the designs in the DAPIA manual as required in the regulations section 3282.451 (3), that IBTS (HUD's agent) has inspected this design in production during their yearly evaluations, and Mr. Parks would know that a wall built to 3280.504(b)(1) has been determined by HUD to be good engineering practice in any geographical climate zone since meeting code is meeting good engineering practice.

To address Mr. Parks conclusions, the exterior wall of the Murphy's residence are assumed to be constructed with vinyl covered gypsum wallboard, 2 x 4 stud construction with R-11 batt insulation. This construction method conforms to section 3280.504(b) (1) of the Federal Manufactured Home Construction and Safety Standard.

Section 3280.504(b) (1) states, "Exterior wall must have a vapor retarder with a permeance no greater than 1 perm (dry cup method) installed on the living space side of the wall" The vinyl covered gypsum has a perm rating of less than 1 which conforms to the prescriptive requirements of section 3280.504 (b) (1).

The wall designs utilized in the Murphy's residence meeting 3280.504(b)(1), is the most widely utilized condensation control method used in walls in the manufactured housing industry for all climatic conditions and have been approved by all of the DAPIA's as required by the regulations. These designs have been reviewed and inspected in-plant by IBTS, HUD agent, and they have determined the constructions method for condensation control in walls utilized in the Murphy's residence conforms to section 3280.504(b) (1) of the HUD Standard.

Section 3280.504 covers condensation control and installation of vapor barriers. Mr. Parks stated in a previous deposition (Courtney Tassin St. Romain v. Cappaert Manufactured Housing) in reference to section 3280.305(b)(1), that gypsum covered wallboard violated the HUD Code because of this one provision." Then Mr. Parks further states that the DAPIA's have committed malpractice and misapplied the wall standards by saying they have violated good engineering practice. Mr. Parks states in another deposition (Herbert Zenon v. Nationwide Housing Systems) that "There are prohibition in the HUD Code that you can't use this type (vinyl covered wall panels) in the south or in Louisiana."

Mr. Parks cannot be an expert in section 3280.504(b)(1) of the code, making these statements. The section 3280.504(b)(1) is prescriptive and states, "Exterior walls shall have a vapor barrier not greater than 1 perm (dry cup method) installed on the living space side of the wall." An expert in the HUD Code must accept the fact that vinyl covered gypsum having a perm of (1) or less meets the HUD Standard for all geographical locations.

Mr. Parks has stated in this deposition that he is not qualified or knows how to use the formula specified in 3280.504(b)(2) to determine the perm rating of exterior coverings. If one does not know how to use this formula, he would not know how to construct a wall conforming to 3280.504(b)(2). In addition, Mr. Parks does not understand the structural requirement necessary to build houses in structural zone

2 and 3 which have a direct bearing on meeting condensation requirements utilizing a wall conforming to section 3280.504(b)(2).

The waiver went into effect in April 2002. Mr. Parks stated in a deposition (Herbert Zenon v. Nationwide Housing) that it was possible to build to the waiver. If Mr. Parks was an expert on the HUD Standard and the waiver, he would have known that in the April 24, 2002 Federal Register HUD did not exempt certain construction (kitchen back-splash material, bathroom tub and shower compartments, cabinetry and built-in furniture, and hardwood plywood paneling under chair rail areas) from the combined interior perm requirement. Without these exemptions it made it impractical to build a house to the waiver. It was not until May 30, 2006 when HUD made exceptions to the construction of the interior finish, was it practical to build to section 3280.504 (b)(4).

Mr. Parks has stated in writing that any chosen design will function properly if sections such as 3280.505 and 3280.103 are met. Mr. Parks also stated in his deposition in this case that sections 3280.103 and section 3280.504 were constructed by the manufacturer to conform to the HUD Standards. I agree with Mr. Parks that any of the three (now four) wall designs specified in section 3280.504(b) will function properly if sections 3280.505 and 3280.103 are met.

Mr. Parks stated that there was elevated moisture content within the perimeter walls causing structural damage and softening and deflection. Mr. Parks checks moisture content in the interior walls (10% - 12%) and compares it to the exterior walls (25-40%) and states there are elevated moisture content in the exterior walls. Mr. Parks does not provide any reference or documentation as to what acceptable moisture content in gypsum is. Mr. Parks does not provide any reference or documentation as to what moisture content must be achieved for gypsum walls to begin to deteriorate. I visually did not find any walls in the Murphy's residence that had elevated moisture that had caused structural softening or deflection. All of the exterior walls were investigated and found to be structural sound. Based upon my personal knowledge of comparative tests run on vinyl covered gypsum at the NTA, Inc. Testing Facility, it was determined a surface moisture reading by a Delmhorst Moisture Meter (Model Accuscan) of 30% would have a moisture reading by a Delmhorst pin type (model BD-2100) of 1.10% and an actual moisture content of 1.9% when tested in accordance with ASTM D-4442 modified for gypsum. This comparison clearly shows that the readings Mr. Parks takes with his surface moisture meter do not identify the moisture content of the gypsum board.

Samples of 5/16 vinyl covered wall board were taken from the Murphy residence by Francis Colin on December 4, 2007 and received by PEI

representatives on December 8, 2007. Samples were cut down to 12" width by length (for the flexural strength test), 3" x 12" (for the core-hardness test), 6" x 6" (for the nail pull resistance test), and 4" x 4" (for the moisture content test). Tests were conducted to ASTM C1396-06a at the PEI laboratory in Goshen, Indiana with the following results (see attached report):

		Actual	Min.
ASTM C473-06a	Flexual Strength Test	116 Lbf	62 Lbf
ASTM C473-06a	Core Hardness Test	37 Lbf	11 Lbf
ASTM C473-06a	Nail Pull Resistance	84 Lbf	46G Lbf
Moisture Content	.61%		

PEI is an independent accredited laboratory certified to perform gypsum test to ASTM C1396-06a. The results of the test performed on the vinyl covered gypsum board from the Murphy home shows that the vinyl covered gypsum wall board has the structural integrity to meet the requirement of ASTM C1396-06a.

The exterior sheathing was removed or drilled to expose the wall cavity at locations where Mr. Parks took air samples and in other locations on each side of the house. All except one location showed that the wall cavities had no signs of mold, mildew, or moisture. These areas included the location at the front door and on the endwall in the second bedroom where Mr. Parks indicates in his report that he took air samples. During our investigation of the second bedroom endwall, we were unable to locate the typical probe holes used by Mr. Parks to take air samples.

When the cavity in the master bedroom bathroom at the location of Mr. Parks probe hole was opened, signs of mold/mildew were evident. When the entire exterior sheathing was removed in this area a water stain at the base of the lavatory was visible. This water stain extended up approximately 18" and behind the lavatory and over to the tub. Since there is no carpet under the tub, water would be free to flow on top of the decking and accumulate in the gypsum wall board around the tub. It was apparent that bulk water had entered the cavity from a possible leak at the lavatory along the floor and through capillary action wicked up the paper side of the gypsum. Mr. Murphy stated in his deposition that the water piping under the bath lavatory "blowed out" causing a water leak which confirms our findings in the wall that a bulk water leak occurred which stained the back of the gypsum wall board. This would explain why the walls in the master bedroom bathroom had excessive moisture and mold/mildew evident. Mr. Parks, in his deposition, could not determine if this mold was active or old.

Mr. Murphy stated in his deposition, that he suspected the roof was leaking and filed a claim with his insurance company, American Home. American Home sent

out an investigator who indicated from a visual inspection, there were no leaks and the claim was denied.

Mr. Parks interviewed the Murphy's as part of his investigation and failed to ask if there were any bulk water leak possibilities, such as roof leaks or plumbing leaks, which may be the possible cause of mold as identified in the master bedroom bathroom.Mr. Parks just assumed the vinyl wall covering is the cause without doing a through investigation, even though he clearly notes that the walls as constructed meets code.

The wall in the master bathroom between the tub and lavatory had a 2" x 2" x 1/8" indentation in the wall that was apparently caused by Mrs. Murphy falling against the wall, according to her deposition. I was told that this area was soft, but at the time of my inspection the wall was structurally sound.

This home has a Ventilaire P.O.S. whole-house ventilation system as required by section 3280.130(b) which is required to bring in positive fresh air from the outside when the furnace is operating. My inspection of the Ventilaire P.O.S. system flex pipe showed that the flex pipe was not attached to the "A" coil as required by the furnace manufacturer, but it was run vertically and horizontally and attached to the wall then turned down towards the "A" coil. It is my opinion that the installation of the P.O.S. may be slightly restricted, but it would not have any effect on the performance of the home, since according to Mr. Parks' deposition, in this case the amount of negative pressure in the house was negligible.

However Mr. Parks does not understand the requirements of balanced pressure as specified in section 3280.103.

Section 3280.103 of the HUD Standard requires "the ventilation system or provisions shall not create a positive pressure in U-Value zones 2 and 3 or a negative pressure condition in U-Value zone 1". Mr. Parks has stated in previous testimony, an exhaust system provided in zone 1 or a P.O.S. system in zone 2 and 3 do not meet the HUD Code. If Mr. Parks was an expert in this section of the HUD Standard, he would know that in 1997 a test protocol was developed by the Levy Partnership for determining balanced pressure and this was reviewed by HUD with the following determination:

"Based upon the test results, the Department has determined there is a basis to consider the passive capacity of bathroom and kitchen exhaust fan assemblies to be used either individually or in combination to provide the required exhaust for

whole house ventilation systems [24 CFR 3280.103(b)]. However, any such assembly approved for this purpose must meet the following conditions:

> 1. The assembly is evaluated in accordance with the test protocol described in the Levy Partnership report of March 3, 1977: "Measured air flow capacity through engineered orifices/comparative testing of passive ventilators in manufactured homes".

This test protocol proved that using an exhaust fan in U-value Zone I and a P.O.S. system in U-value 2 & 3 in conjunction with an approved bath or range hood fan will meet the requirements of 3280.103(b).

This clearly shows that Mr. Parks is not an expert and does not have a clear understanding of section 3280.103 of the HUD Standard. Since 1997 all manufacturers that provide a combination mechanical and passive systems to meet the requirement of 3280.103(b) for balanced pressure rely on the determination made by HUD and rely on the test protocol of the Levy Partnership.

The Murphy's residence is provided with exterior sheathing which is the pressure envelope which limits air infiltration, per section 3280.505 of the HUD Standard.

Section 3280.505(a) states, "The opaque envelope shall be designed and constructed to limit air infiltration to the living area of the home". In section 3280.505(a) the purpose of "the goal of the infiltration control criteria is to reduce heat loss/heat gain due to infiltration as much as possible without impinging on health and comfort within the limits of reasonable economics."

The pressure envelope is defined in section 3280.502(a)(1) as "That primary air barrier surrounding the living space which serves to limit air leakage, in construction using ventilated cavities, the pressure envelope is the interior skin." The Murphy's residence wall design is an unventilated wall cavity utilizing the exterior sheathing as the pressure envelope. Section 3280.505(a) (2) states, "When walls are constructed to form a pressure envelope on the outside of the wall cavity, they are deemed to meet this requirement."

It is my opinion that the Murphy's residence is constructed with an exterior pressure envelope with the exterior sheathing installed in a manner that will limit air infiltration and is in conformance with section 3280.505 of the Standards.

Page 4 & 5 of Mr. Parks report identifies examples of heat transfer found within the walls near the ceiling of the Murphy's residence by using an infrared camera, shown in figure 4, 7, & 9.The different range in temperatures at the locations

were not identified in his report. During our investigation, Mr. Francis Colin took infrared readings in the same location as Mr. Parks and noted that the largest temperature difference did not exceed 3-degrees Fahrenheit. The HUD Standard addresses areas such as the ones shown in the pictures under section 3280.508(c), and refers to these low-R-value heat-flow paths as thermal shorts. The HUD Standards permit a total of 1% of the total exterior surface area to be classified as thermal shorts. The areas identified by the infrared pictures have an aggregate area far less than 1% permitted by the Standards. Therefore, the areas identified by Mr. Parks are known as thermal shorts and conform to the HUD Standards.

Mr. Parks in his deposition states that the air conditioner is sized properly for this house, which in incorrect. The design guides used for determining heat gain and equipment sizing are Manual J and Manual S as developed by the Air Conditioning Contractors of America and recognized by ANSI (American National Standards Institute). Manual J section 5-12 equipment sizing states "The total sensible and total latent load shall be used for equipment sizing (exactly as they appear on Form J1AE or Form J1) with no '*safety-factor*' adjustment; and manufacturer's expanded performance data shall be used to select cooling equipment and heat pumps." Mr. Parks computer calculations shown that the total heat gain from manual J is 22,385 btuh. Manual S section 3-4 sizing limitations states "Gross oversizing is not recommended because part-load temperature control, humidity control, operating costs, and installation costs are adversely affected when the equipment has an excessive amount of cooling capacity. In this regard, the acceptable amount of excess capacity will depend on the application.

- Cooling-only equipment should be sized so that the total cooling capacity does not exceed the total cooling load by more that 15 percent."

Based upon these design requirements from Manual J and S using the total load from Mr. Parks calculation the maximum design of the cooling equipment should not exceed 25,743 btuh (22,385 btuh x 1.15).

Based upon the equipment sizing requirement Manual S the 3 ½ ton AC is grossly oversized for the Murphy house based upon Mr. Parks' calculations.

Mr. R.T. Bonney report dated May 22, 2006

Mr. R.T. Bonney's report does not give specific code violations, but only reference on the final page of his report that "wet condition occurring in the vinyl

covered wall board." My visual inspection of the wall surface and the cavity at the location where sheathing was removed showed all of the walls were dry and within industry Standards.

The crawl space of the Murphy's residence was not provided with proper cross ventilation to dissipate moisture. Mr. Bonney states the area beneath the rear deck is open. He also states that cross ventilation is necessary to blow thru the crawl space to exhaust moist air.

The Southern Energy Installation Instructions require "vents should be placed to provide adequate maximum effectiveness (no unventilated pockets). Failure to provide adequate ventilation may allow moisture to collect under the home. Excessive moisture underneath the home can increase infiltration of moisture into the home, possibly causing damage to floors, walls, and interior finish." And, "ventilation openings shall be placed at or near each corner of the home and as high as practical. Openings shall be located to provide cross ventilation on at least two opposite sides."

The front concrete porch is against the vinyl siding and the surface grade is even with the house around the front and ends restricting ventilation. In addition, there is a row of railroad ties around the perimeter up to the rear porch that is up against the side of the house. The International Building Code requires under section R401.3 drainage that the grade be sloped from the foundation walls a minimum 6" fall within the first 10 feet. With the railroad ties up against the house, proper drainage is not provided and water from the roof will pour on to the railroad ties and into the crawl space.

Mr. Kondner, P.E. report dated October 18, 2007

Mr. Konder has provide a narrative of generalization (nothing specific to the Murphy's residence) on vinyl wall board in hot an humid climates without providing any documented technical data substantiating and of his finding or conclusions. Mr. Kondner did not inspect the Murphy house and is basing his opinion only on the reports of Mr. Parks and Mr. Bonney.

It should be noted that this report is almost identical to a report written in a similar legal case (Deese vs Champion) where Mr. Kondner draws the same conclusions about vinyl wall board, when vinyl wall board was not even used in the Deese home.

Mr. Kondner bases his conclusion on a report prepared by Mr. R.T. Bonney on July 5, 2006. The only report of Mr. Bonney I have been provided

with is dated May 22, 2006. Therefore my comment will only pertain to that report.

Mr. Kondner states in his report that for years manufactured housing has suffered from water vapor condensation moisture problems caused by humid, hot moisture in the southeastern part of the United States when using gypsum vinyl wall boards. Gypsum vinyl wall boards have been used in the industry since the mid 1980's. Since that time there have been thousands of homes shipped to the humid and fringe climate as defined by HUD in the April 24, 2002 waiver without wall problems. In my position as a DAPIA and IPIA under the HUD program, if problems do arise with manufacturers we would be notified by HUD to do an investigation and to determine the source of the problem. To date HUD has not identified any problems with wall construction that would warrant a class investigation as required by the regulations 3282 Subpart I. I have only investigated one house with a wall problem in Florida in the early 2000's and did not determine that source of the problem. On the house I investigated I did not know if the finish on the gypsum wall board was vinyl or paper.

It is my opinion that Mr. Kondner is wrong in his statement, and that there are no documented studies that conclude that vinyl wall boards are the cause for any moisture related problems in walls in the hot and humid climates.

Mr. Kondner states on page 3 that in March 2000 HUD issued a waiver to "CFR 3280.504 "Condensation control and installation of vapor retarders"". Mr. Kondner states that "The waiver process allows manufacturers of manufactured houses constructed to be sited in hot, humid and fringe climates to install the vapor retarder on the exterior side, rather than the interior or living space side, of the exterior walls provided that the permeability of the exterior wall has a vapor retarder or exterior covering with a permeability not greater than 1.0 perm and the interior or living space side of the wall with a permeability of 5 perms or greater. The waiver also requires manufactures to add a statement and a map to the data plate of the home stating that the house is only suitable for installation in humid and fringe climates".

The statement clearly shows that Mr. Kondner is not a HUD expert or familiar with the regulatory process. The Federal Register March 30, 2000 was a notice of a proposed waiver and requesting public comment. The actual waiver was issued on April 24, 2002. Mr. Kondner's statement that homes could be built to the waiver in March 2000 is incorrect. In fact the waiver as issued on April 24, 2002 was not possible for a manufacturer to build to as it was written. In the Federal Register April 24, 2002 under comments "The department did not accept a further recommendation of MHI and another commenter to exempt certain

construction (kitchen back splash materials, bathroom tub an shower compartments, cabinetry and built-in furniture, and hardwood plywood paneling under chair rail areas) from the combined interior perm requirement, because the department does not have technical data to support their proposal".

By HUD not accepting MHI's recommendation the manufacturers recognized they could not build to the waiver. It was not until May 30, 2006 that HUD recognized the problem with the waiver and accepted MHI's recommendations making the waiver practical.

Mr. Kondner states on page 5 that building a wall with vinyl wall covering is "A clear violation of 24 CFR3280.303(b) because it is a direct violation of "accepted engineering practice" and is not in conformance with the performance requirements of providing and insuring "durable, livable, and safe housing." Section 3280.1 scope states "This standard seeks to the maximum extend possible to establish performance requirements. In certain instances, however, the use of specific requirement is necessary." The end result of all code requirements must show performance and Section 3280.1 is describing the two ways that are available to obtain the performance required.

If a code section is written in general terms without specific requirements the designer can choose any design method to achieve performance. If a code section is specific (prescriptive) the designer must not deviate from the requirement, because it has been determined if the specific (prescriptive) requirements are met they will perform based upon past experience and all technical documentation provided to HUD. In the case of Section 3280.504 condensation control and installation of vapor retarders there are 3 specific requirements that if adhered to will meet the code and perform in all geographical climatic areas. HUD requirement as stated in 24 CFR3280.303(b) are general requirements and do not apply to the specific requirements as stated in 24 CFR3280.504(b).

Over the 30 years in the HUD program HUD or their agents IBTS through in-plant audits and design review have never applied 24 CFR3280.303(b) to any specific design requirement. In a letter from Mr. William W. Matchneer III dated Jan. 19, 2007 he confirms the position of HUD that "There is no case in which HUD has applied 3280.303(b) to a manufacturer that has complied with 3280.504(b).

Mr. Kondner states that building a wall with vinyl covered gypsum in the humid or fringe climates does not meet good engineering practice. As state earlier in the response to Mr. Parks report" HUD oversees the Federal Manufactured Home Construction and Safety Standard and develops the code through a

consensus process that relies on professionals that have expertise to make recommendations to a consensus committee by supplying conclusive technical documentation on issues that will become code and establish good engineering practice. Meeting the specific requirements of the codes is meeting good engineering practices.

Section 3282.361(b) states "(1) In evaluating designs for compliance with the standards, the DAPIA will not allow any deviations from accepted engineering practice standards for design calculations or any deviations from accepted test Standards, except that the DAPIA, for good cause, may request the Secretary to accept innovations which are not yet acceptable practices. Acceptances by the Secretary shall be published in the form of interpretative bulletins, where appropriate." It is the responsibility of the DAPIA to insure good engineering practice is met, which is following the Standards as written and obtaining interpretations from the Secretary when appropriate.

The DAPIAs have been told in numerous meetings with HUD Regulators since June 15, 1976, that they must adhere to the Standards as written and applying additional requirements not in the Standards or making interpretation of the Standards is considered rulemaking and must go through the process as required in the regulations section 3282."

Quality Assurance process of Southern Energy:

All manufacturers building under the Federal Manufactured Housing Construction and Safety Standards are required to have a ridgid quality assurance process. Southern Energy Homes has a Quality Assurance process as required by 3282 of the HUD Regulations. Southern Energy Homes is required to submit all information necessary under the Regulation (section 3282.203) as required by the Design Approval Primary Inspection Agency (DAPIA) in order to carry out design approvals. IBTS as HUD Agent is required by section 3282.451(e) of the HUD Regulation, to monitor the DAPIA's on a random basis at least 10% of the design and quality Assurance manual approvals made by each DAPIA in each year. The designs submitted by Southern Energy for condensation control in walls (section 3280.504(b), limiting infiltration (section 3280.505), and whole-house ventilation (section 3280.103(b) have been evaluated by NTA, Inc. (DAPIA) and monitored by IBTS, and have been found to be in conformance with the HUD Standards.

Southern Energy Homes inspects each unit 100% through each station and documents on a Traveler that all work in process has been in accordance with the approved Design Manual or the Standards. Southern Energy's Assurance process

is monitored by NTA, Inc. as required by The Regulations under section 3282.362. NTA, Inc. conducted an initial plant certification in accordance with section 3282.362(b). This plant certification consisted of NTA, Inc. inspecting each station 100% and following at least one unit through the production process until NTA, Inc. was assured that the Southern Energy Quality Assurance process is functioning in accordance with their Approved Quality Assurance program and the HUD Regulation. HUD's agent, the Institute of Building Technology and Safety (IBTS) monitors NTA, Inc. in accordance with section 3282.451. IBTS will inspect the Southern Energy plants to insure NTA, Inc. is following the HUD Regulations to insure that Southern Energy Homes have a functioning Quality Assurance process. IBTS has specific checks that are used to inspect condensation control of exterior walls (section 3280.504(b), CCI 37.2), limiting air infiltration between major envelope elements (section 3280.505(a) 2 and 3280.307(b)), CCI 38.1) treatment of penetrations in the pressure envelope (section 3280.505(a), CCI 38.2), and whole-house ventilation (section 3280.103(b) CCI 4.2). The CCI (Computer Coded Items) identification is the IBTS number used during their inspection to thoroughly inspect each aspect of each design. The construction methods and design utilized by Southern Energy Homes for condensation control in walls, limiting air infiltration, and whole-house ventilation have been evaluated by NTA, Inc. and IBTS during in-plant inspection and they conform to the approved DAPIA designs and the Standard.

The State Administrative Agency (SAA) which is the State of Alabama, make dealer lot inspections to monitor any defects due to transportation, inspects each manufacturing facility to check records and to handle consumer complaints which is another oversight review of the manufacturer. All of these required checks by NTA, Inc. and IBTS monitor the Southern Energy Homes plants to insure compliance to the approved design manual, manufacturer's instructions and the Federal Manufactured Housing Construction and Safety Standards.

Conclusion: Walls constructed to section 3280.504(b)(1) of the HUD Standards and whole house ventilation systems consisting of a Ventilaire P.O.S. system installed at the furnace conform to section 3280.103 of the HUD Standards are utilized by most of the manufacturer's building HUD Code homes.

It is my opinion that based upon the information provided in this report Mr. Parks is not an expert in the HUD Standards and lacks the understanding of what is required in sections 3280.103, 3280.303 or 3280.504 to conform to the HUD requirements.

It is my opinion that based on the information provided in this report Mr. Knodner, P.E. is not an expert in the HUD standards and lacks the understanding

of what is required in section 3280.303 or 3280.504 to conform to the HUD requirements.

It is my opinion to a reasonable degree of engineering certainty that the vinyl covered gypsum wall board in the Murphy's residence is structurally sound as verified by the tests performed by PEI, an independent accredited testing laboratory.

It is my opinion that the HUD Requirements as stated in 24 CFR3280.303(b) are general requirements and do not apply to the specific requirements as stated in 24 CFR 3280.504(b).

To a reasonable degree of engineering certainty, it is my opinion and the opinion of Mr. Parks as stated in his deposition in this case, that the wall construction in the Murphy's residence conforms to section 3280.504(b)(1) and 3280.505 of the Federal Manufactured Home Construction & Safety Standards.

If you have any questions on the above report, please do not hesitate to contact the undersigned.

David R. Tompos, P.E.
Vice President/General Manager
NTA, Inc.

DRT/ap

Progressive Engineering Inc.

mSolve Building Science Service

Evaluation of 5/16" Vinyl Covered
Gypsum (Murphy Home) to ASTM C1396

12/10/2007

This test report contains twenty five (25) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2007-1805

58640 State Road 15 - Goshen, IN 46528
Phone: 574-533-0337 - Fax: 574-533-9736
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1. TITLE

Evaluation of 5/16" Vinyl Covered Gypsum (Murphy Home) to ASTM C1396

2. OBJECTIVE

Evaluation of the Flexural Strength; Core Hardness; Nail Pull Resistance; and Moisture Content of the 5/16" vinyl covered gypsum board taken from an exterior wall in the Murphy Home. *The residence and location of the material used for this test was provided to PEI by mSolve Building Science Service.*

3 TESTED FOR

mSolve Building Science Service
705 Watts Street
Durham, NC 27701

4. TESTING ORGANIZATION

Progressive Engineering, Inc.
58640 State Road 15
Goshen, IN 46528

See IAS Evaluation Report TL-178 for ISO 17025 Accreditation

5. TESTING PERSONNEL

Laboratory Manager - Jason R. Holdeman Jason R. H

6. REFERENCE STANDARDS

ASTM C 472 - 99(2004) - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.

ASTM C 473 - 06a - Standard Test Methods for Physical Testing of Gypsum Panel Products

ASTM C 1396 - 06a - Standard Specification for Gypsum Board

7. TEST EQUIPMENT

Tinius Olsen Hydraulic Tension/Compression Machine - (***PEI*** #144)
ASTM C473 Flexural Test Fixture - (***PEI*** #546)
ASTM C473 Nail Pull and Hardness Tester - (***PEI*** #548)
Digital Scale, 400g - (***PEI*** #629)
Temperature and Humidity Meter - (***PEI*** #681)
Desiccant - Calcium Chloride
Nail Pull Support Fixture - (***PEI*** #547)

8. TEST SPECIMEN

The material consisted of a 5/16" vinyl covered gypsum board with no indication of the manufacturer. The average measure thickness was .329". One of the panels tested did have the following markings on the back paper: "CLASSIFIED-GYPSUM WALLBOARD MH 26737 SHEAR RESISTANCE" and "DIRECTORY ASTM E72 CONTROL 283066-003". The specimens used for this series of tests were cut from an exterior wall in the Murphy Home and shipped via FedEx Priority Overnight, from Ilene DuCote of Ritchey & Simpson, PLLC on 12/6/07, to PEI enclosed in plastic bags. See the attached photographs and Material Log Sheet for the "As Recieved" details.

9. TEST SPECIMEN CONSTRUCTION

Flexural Strength

A. The sample was removed from the packaging and labeled with the Box Letter and a sample number.
B. Photographs were taken of each side of the sample.
C. The samples were cut down to a 12" width and the length was kept as received. Each sample was labeled for Flexural Strength (FS).
D. The sample was then immediately tested.

Core, End and Edge Squareness

A. The sample was removed from the packaging and labeled with the Box Letter and a sample number.
B. A 3" x 12" piece was cut out of the sample sheet and labeled for Core Hardness (CH).
C. Photographs were taken of each sample and then placed back into the plastic bag until the time of the test.

9. TEST SPECIMEN CONSTRUCTION (cont.)

Nail Pull Resistance

A. The sample was removed from the packaging and labeled with the Box Letter and a sample number.
B. A 6" x 6" piece was cut out of the sample sheet and labeled for Nail Pull (NP).
C. Photographs were taken of each sample and then placed back into the plastic bag until the time of the test.

Moisture Content

A. The sample was removed from the packaging and labeled with the Box Letter and a sample number.
B. A 4" x 4" piece was cut out of the sample sheet and labeled for Moisture Content (MC).
C. The sample was then immediately weighed and recorded as the Initial Weight.
D. Photographs were taken of each sample.

10. TEST SETUP

Flexural Strength

The test specimens were placed a fixture constructed in accordance to ASTM C 473, Section 11.3.1. This fixture and specimen were placed in a Tinius Olsen test machine. See attached Fixture Drawing no. F969.

Core Hardness

The test specimens were secured in a vertical clamp fixture. The fixture and specimen combination was placed in a Tinius Olsen test machine. The hardness tester was attached to a rigid crosshead and suspended over the centerline of the specimen core thickness. See attached Fixture Drawing no. F1216.

Nail Pull Resistance

The test specimens were placed on the Nail Pull Support Fixture so that the 7/64" center of the test specimen was centered within the 3" diameter support hole. The test specimen and Nail Pull Support Fixture were placed in the Tinius Olsen test machine so that the Nail Pull Tester entered the 7/64" center hole, and was perpendicular to the face of the test specimen. See attached Fixture Drawing no. F971.

10. TEST SETUP (cont.)

Moisture Content

The samples were placed into a dry oven and positioned so that all surfaces and three edges were completely exposed to the dry air.

11. TEST PROCEDURE

Flexural Strength

A. The specimen was loaded at the midspan across the entire 12" width, parallel to the supports, with the vinyl surface up or in contact with the loading nose.
B. The load was applied at a rate of one (1) inch per minute until the test sample reached failure. Failure was considered a significant loss of load followed by no appreciable gain.
C. The maximum load attained was recorded along with any observations.
D. The test process was repeated for all test specimens.

Core Hardness

A. The specimen was loaded perpendicular to the edge at three (3) locations as defined in ASTM C473, Section 12.6.
B. The load was applied at a rate of one (1) inch per minute until the tester was inserted approximately 1/2" into the core.
C. The maximum load attained was recorded along with any observations.
D. The test process was repeated for all test specimens.

Nail Pull Resistance

A. The specimen was loaded perpendicular to the vinyl surface.
B. The load was applied at a rate of one (1) inch per minute until the tester was inserted approximately 1/2" into the core.
C. The maximum load attained was recorded along with any observations.
D. The test process was repeated for all test specimens.

Moisture Content

A. The specimens were weighed periodically until a constant weight was attained. Constant weight was considered a weight change of less than 0.1%.
B. The samples were then placed into a desiccator container and allowed to cool.
C. The samples were removed one at a time from the desiccator container and immediately weighed and recorded as the Dry Weight.

11. TEST RESULTS

See attached data pages for test results.

12. CONCLUSION

The specimens tested **MET** the requirements as defined in ASTM C1396-06a for Flexural Strength, Core Hardness and Nail Pull Resistance in the condition received. The Free Water Moisture Content for the samples "As Received" was an average of **0.61%.**

The specimens used for this test were not conditioned in accordance with ASTM C473 per the request of mSolve Building Science Service, in order to determine the material strength as found in the residence. The samples were wrapped in the plastic bags to limit the "preconditioning" during shipping and lab storage.

Progressive Engineering Inc.

Material Log Sheet

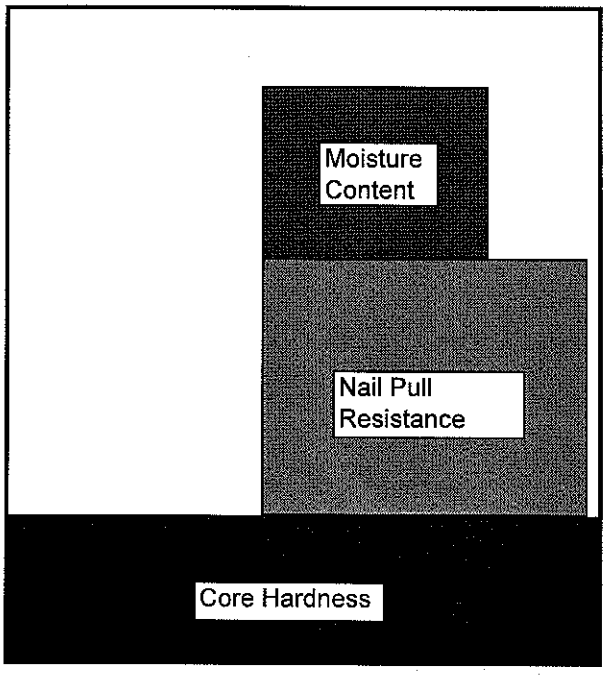
Received On: 12/6/07

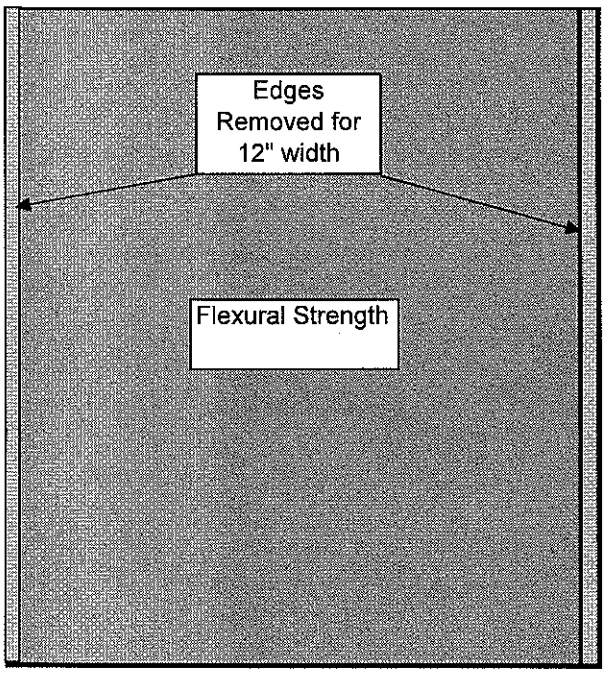
Sample Conditon: See attached photographs for "As Received" condition. The sample sizes and weights were taken with the plastic wrap sealed and then samples were chosen at the maximum, minimum, and average grams per square inch to act as a sampling method.

Material 'As Received' - With Plastic Wrap

Box	PEI Sample ID	Width (in)	Length (in)	Weight (g)	Surface Area (in^2)	Panel (g/in^2)	Test Type for Each Sample		
A	A1	14.5	16	899.1	232.0	3.88	Moisture	Nail Pull	Core
	A2	14.5	16.125	912.8	233.8	3.90	Flexural		
	A3	14.625	16.125	919.1	235.8	3.90			
B	B1	14	16	874.5	224.0	3.90	Flexural		
	B2	14	17	906.8	238.0	3.81	Moisture	Nail Pull	Core
	B3	14.5	16	908.4	232.0	3.92	Moisture	Nail Pull	Core
C	C1	14.5	16.625	932	241.1	3.87	Flexural		
	C2	14	16.125	877.8	225.8	3.89			
	C3	14.125	16.125	883.7	227.8	3.88	Moisture	Nail Pull	Core
	C4	14	16.125	878.8	225.8	3.89	Flexural		
D	D1	13.875	16.125	867.4	223.7	3.88			
	D2	14	16.125	864.2	225.8	3.83	Moisture	Nail Pull	Core
	D3	13.875	16.125	861.8	223.7	3.85	Flexural		
					Minimum	**3.81**			
					Maximum	**3.92**			
					Average	**3.88**			

Typical Sample Removal Locations





Progressive Engineering Inc.

ASTM C 473-06a Flexural Strength (Method B)

Date: 12/8/2007
Client: mSolve Building Science Service

Project No.: 2007-1805
Test Condition: 69.0 °F and 29% R.H.
Load Rate: 1" per minute

Specimen: 5/16" Gypsum (Vinyl Covered) - Murphy Home

Flexural properties of gypsum panel products were evaluated by supporting the 12" x 16" specimen near the ends (14" span) and applying a load at the midspan.

Test No.	Test Sample	Sample Alignment	Maximum Load Reached	Failure Description
1	A2-FS	Vinyl Side Facing Up	115 lbf	Core and bottom paper broke at midspan
2	B1-FS	Vinyl Side Facing Up	119 lbf	Core and bottom paper broke at midspan
3	C1-FS	Vinyl Side Facing Up	114 lbf	Core and bottom paper broke at midspan
4	C4-FS	Vinyl Side Facing Up	117 lbf	Core and bottom paper broke at midspan
5	D3-FS	Vinyl Side Facing Up	117 lbf	Core and bottom paper broke at midspan

			Minimum Breaking Load per ASTM C1396-06a
Average Max Load Reached	Edge Parallel Facing Side Up	N/A	21 lbf
	Edge Parallel Facing Side Down	N/A	21 lbf
	Edge Perpendicular Facing Side Up	N/A	62 lbf
	Edge Perpendicular Facing Side Down	N/A	62 lbf
	Samples as listed above	**116 lbf**	

Comments/Observations: The specimens for this test were kept in the AS RECEIVED packaging until the time of test. The samples were removed from the packaging, cut to size and immediately tested. This procedure was repeated for each sample. There was adhesive on a few samples and this was scraped off prior to testing. The direction fo the adhesive line was parallel to the 16" dimension and would indicate that the samples were cut parallel to the framing and thus in the machine direction of the board, assuming a vertical installation. This assumption would set the requirement for these samples at 62 lbf per ASTM C1396.

Progressive Engineering Inc.

ASTM C 473-06a Core Hardness (Method B)

Date: 12/8/2007
Client: mSolve Building Science Service

Project No.: 2007-1805
Test Condition: 70 °F and 27% R.H.
Load Rate: 1" per minute

Specimen: **5/16" Gypsum (Vinyl Covered) - Murphy Home**

Core Test

Test No.	Test Sample	Test A	Test B	Test C	% 15 off Replacement
1	A1-CH	36 lbf	29 lbf	31 lbf	
2	B2-CH	32 lbf	30 lbf	32 lbf	
3	B3-CH	35 lbf	33 lbf	30 lbf	
4	C3-CH	34 lbf	32 lbf	~~38 lbf~~	35 lbf
5	D2-CH	30 lbf	~~26 lbf~~	34 lbf	33 lbf

Average = **32 lbf**
Minimum Hardness = **11 lbf**
per ASTM C1396-06a

Comments/Observations: The samples used for this test were cut from the same specimens used for moisture content testing. The typical result was a 2" fracture in the gypsum core, extending longwise to the paper edges on either side of the puncture. The fracture typically terminated at the same paper side but in a couple of instances broke through the core diagonally and terminated on opposing paper faces.

Progressive Engineering Inc.

ASTM C 473-06a Nail Pull Resistance (Method B)

Date: 12/8/2007
Client: mSolve Building Science Service

Project No.: 2007-1805
Test Condition: 70.0 °F and 29% R.H.
Load Rate: 1" per minute

Specimen: **5/16" Gypsum (Vinyl Covered) - Murphy Home**

Test No.	Test Sample	Maximum Load	% 15 off Discard	Comments/Observations
1	A1-NP	96 lbf		The samples used for this test were cut from the same specimens used for moisture content testing. Vinyl Side UP. Nail head cut the vinyl and the back of the board had an approximate 2" diameter bulge in the paper.
2	B2-NP	91 lbf		
3	B3-NP	92 lbf		
4	C3-NP	69 lbf		
5	D2-NP	74 lbf		

Average = **84 lbf**

Minimum Resistance = **46 lbf**
per ASTM C1396-06a

Progressive Engineering Inc.

Moisture Content - Oven Dry

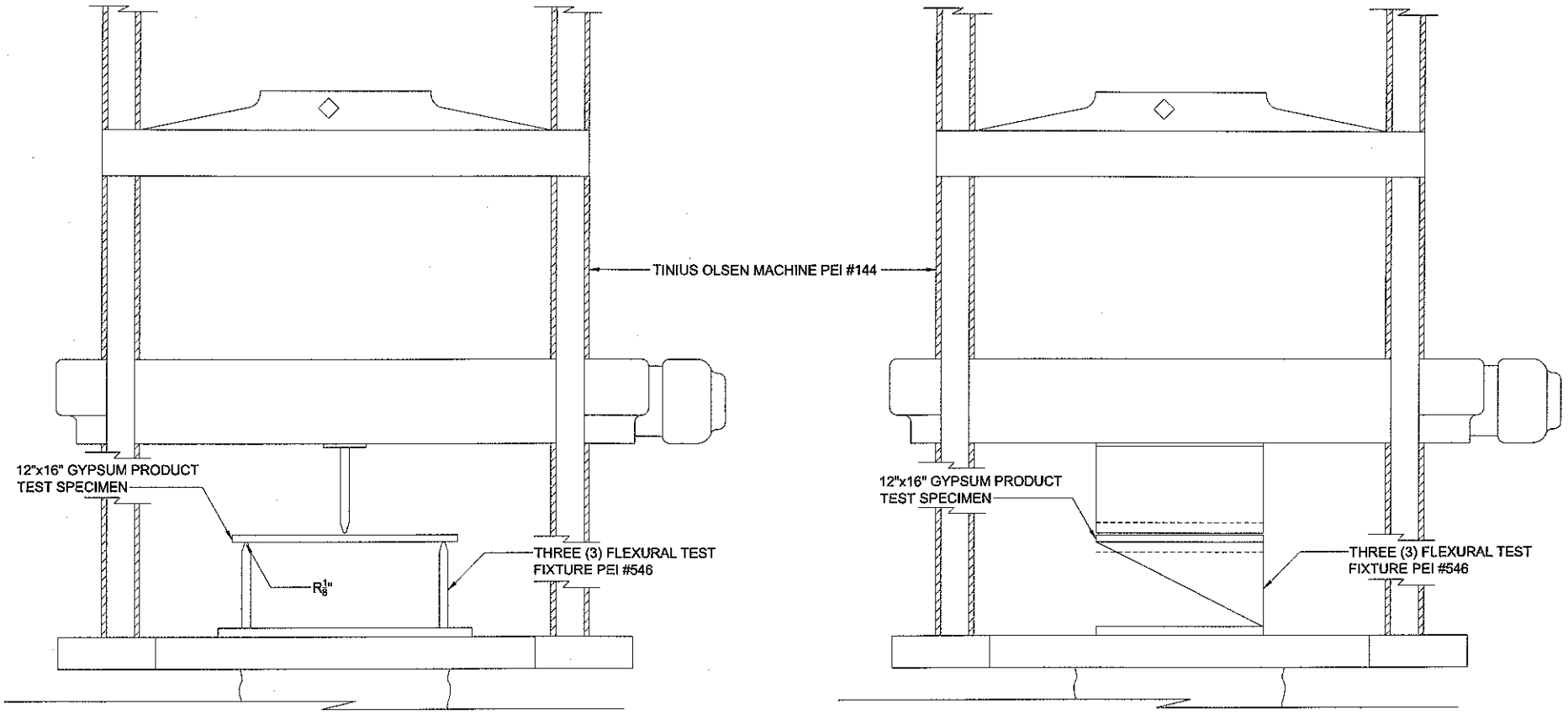
Date: 12/10/2007
Client: mSolve Building Science Service

Project No.: 2007-1805
Cond. Temp.: 113° F
Cond. Humidity: Uncontrolled

Specimen: **5/16" Gypsum (Vinyl Covered) - Murphy Home**
Test: Condition the samples at 113°F until a constant weight is attained. Place the samples in a desiccator chamber, allow to cool, and then re-weigh. Determine the total weight loss and calculate the moisture content as the percent weight loss.

			SAMPLE No. / Weight in Grams (g)				
	Date	Time	A1 - MC	B2-MC	B3-MC	C3-MC	D2-MC
Initial Weight	12/7/07	19:30	61.35	61.47	61.79	60.61	60.80
DRY Weight	12/10/07	18:00	60.96	61.10	61.41	60.23	60.46
Total Weight Loss (g):			0.39	0.37	0.38	0.38	0.34
Free Water Moisture Content:			0.64%	0.60%	0.61%	0.63%	0.56%

Average Moisture Content: **0.61%**



FRONT VIEW

SIDE VIEW

DWN. BY: A.BENDER DATE: 6/15/05 SCALE: DRAWING NUMBER F969	This drawing and all information contained herein is the property of PROGRESSIVE ENGINEERING, INC. and is not to be reproduced without the written permission of Pei. Pei assumes no responsibility for unauthorized use of this drawing. TITLE: TEST SET-UP	Progressive Engineering Inc.	58640 State Road 15 Goshen, IN 46528 Phone (574) 533-0357 Fax (574) 533-9736 www.p-e-i.com